REMARKS

Claims 1-12 are in the case for the Examiner's review and consideration. The Examiner has required an election under 35 U.S.C. §§ 121 and 372 among the following groups, stating that the present application contains "inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1."

> Group I (claims 1-4): Drawn to a polyolefin microporous membrane (428/343);
>
> Group II (claims 5-7 and 9-12): Drawn to a process for producing a polyolefin microporous membrane (246); and
>
> Group III (claim 8): Drawn to a gel-like shaped product (106).

The Examiner contends that the inventions of Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features. In particular, the Examiner contends that the special technical feature of Group II including a solvent for thermally induced phase separation process is not present in Group I and, therefore, unity of invention is lacking between these two (2) groups. Furthermore, the Examiner alleges that unity of invention is lacking between Groups II and III for the same reason. With regard to Groups I and III, the Examiner also alleges that the special technical feature of Group III including a solvent for forming a gel-like product is not present in Group I.

Applicants respectfully traverse the statement.

Firstly, Applicants wish to inform the Examiner that unity of invention pursuant to PCT Rule 13.2 among the original claims as filed was acknowledged by the International Preliminary Examination Authority during the international stage of the present application.

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Secondly, on the contrary to the Examiner's statement above, since the solvent is extracted and removed based on the phase separation during the production process, as recited in the claims of Group II, to form the microporous membrane recited in the claims of Group I, it is proper as a matter of course that the solvent recited in Group II is not recited in the microporous membrane claims of Group I. It should be noted that the microporous membrane of the present invention as recited in the claims of Group I can be produced for the first time by the production process of the present invention as recited in the process claims of Group II.

Thirdly, on the contrary to the Examiner's contention, there is also a technical relationship between Groups II and III as well as II and I involving one or more of the same or corresponding special technical features. Namely, the "gel-like shaped product" of Group III is an intermediate product produced during the process of Group II for preparing the microporous membrane of Group I and, thus, all three (3) Groups clearly relate to a single general inventive concept pursuant to PCT Rules 13.1 and 13.2.

Nevertheless, Applicants herein amend claims 5, 9 and 11 to make the above-argued points clearer regarding the unity of invention.

Accordingly, Applicants respectfully request that the restriction requirement be withdrawn and all the claims be examined.
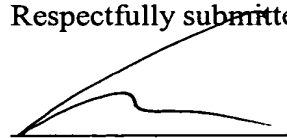
However, in the event that the Examiner maintains the present restriction requirement, Applicants hereby provisionally elect with traverse to prosecute the claims of Group I (claims 1-4) drawn to a polyolefin microporous membrane. The election is made in the present application without prejudice to the prosecution of the non-elected claims in related patent applications. Applicants reserve the right to petition from the restriction requirement under 37 C.F.R. § 1.144.

Favorable reconsideration of all the claims is respectfully requested.

No fee is believed to be due for this submission. Should any fee be required,

please charge such fee to Pennie & Edmonds LLP Deposit Account No. 16-1150.

Respectfully submitted,

Date: September 6, 2002

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Attachments: Exhibits A and B.

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Please amend the claims to read as follows:

5. (Amended) A process for producing [a] **the** microporous membrane **according to claim 1** which comprises using a vinylidene fluoride homopolymer or copolymer having a weight average molecular weight of 1×10^5 or more and a solvent capable of forming a microporous membrane having a percolation structure as defined in (B) below, in a weight ratio of 10 : 90 to 60 : 40; dissolving said vinylidene fluoride homopolymer or copolymer in said solvent at a dissolution temperature Ts at which the percolation structure can be formed and which satisfies the condition described in (C) below; extruding the resulting solution with an extruder; cooling the extruded solution to form a gel-like shaped product composed of a two-phase gel; and then subjecting the shaped product to any treatment selected from the group consisting of the following treatments i), ii) and iii):

i) removing the solvent by use of a volatile liquid without stretching the shaped product,

ii) stretching the shaped product with a stretching residual strain of 100% or less and then removing the solvent by use of a volatile liquid,

iii) removing the solvent by use of a volatile liquid, followed by stretching with a stretching residual strain of 100% or less;

(B) said solvent capable of forming a microporous membrane having the percolation structure being defined as such a solvent that, for solutions of the vinylidene fluoride homopolymer or copolymer with a weight average molecular weight of 1×10^5 or more having concentrations in a range of 10 to 60 wt%, when dissolution temperature Ts is plotted as abscissa at regular intervals of 5°C, starting from Ts = 100°C, and the breaking extension TL of a membrane produced from the solution having each dissolution temperature is plotted as ordinate, a dissolution temperature at which
$- (TL_{S+5} - TLs) / \{ (Ts + 5°C) - Ts\}$ (wherein TL_{S+5} is a TL value at Ts + 5°C and TLs is a TL value at Ts) becomes maximum is taken as Ts max, and a temperature 2.5°C higher than Ts max (Ts max + 2.5°C) is taken as Tu; on the other hand, when Ts is plotted as abscissa and

the porosity P of the membrane as ordinate in the same manner as above, a dissolution temperature at which $(P_{s+5} - Ps) / \{(Ts + 5\,°C) - Ts\}$ (wherein P_{s+5} is a P value at $Ts + 5\,°C$ and Ps is a P value at Ts) becomes maximum is taken as T's max, and a temperature $2.5\,°C$ higher than T's max (T's max + $2.5\,°C$) is taken as Tl; and at least one solution having a concentration in the above range of the concentration of the vinylidene fluoride homopolymer or copolymer has both Tl and Tu in such a way that (Tu - Tl) > 0;

    (C)   Tl$\leqq$ Ts$\leqq$ Tu

     9. (Amended) A process for producing [a] **the** microporous membrane **according to claim 1** which comprises using a vinylidene fluoride homopolymer or copolymer having a weight average molecular weight of 1×10^5 or more and a mixture of a solvent capable of forming a microporous membrane having a percolation structure which is defined in (B) below and a thermoplastic resin miscible with said vinylidene fluoride homopolymer or copolymer, in a weight ratio of 10 : 90 to 60 : 40; dissolving the vinylidene fluoride homopolymer or copolymer and the thermoplastic resin miscible therewith in the said solvent at a dissolution temperature Ts at which the percolation structure can be formed and which satisfies the condition described in (C) below, under such conditions that the total amount of said vinylidene fluoride homopolymer or copolymer and the thermoplastic resin miscible therewith is 60 wt% or less based on the weight of the resulting solution consisting of said vinylidene fluoride homopolymer or copolymer, said thermoplastic resin and said solvent, and the weight ratio of said vinylidene fluoride homopolymer or copolymer to the thermoplastic resin miscible therewith is 40 : 60 to 90 : 10; then extruding the solution with an extruder; cooling the extruded solution to form a gel-like shaped product composed of a two-phase gel; and then subjecting the shaped product to any treatment selected from the group consisting of the following treatments iv), v) and vi):

     iv)   removing the solvent and the thermoplastic resin miscible with the vinylidene fluoride homopolymer or copolymer by use of a volatile liquid without stretching the shaped product;

     v)   stretching the shaped product with a stretching residual strain of 100% or less, and then removing the solvent and the thermoplastic resin miscible with the vinylidene fluoride homopolymer or copolymer by use of a volatile liquid; and

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vi)   removing the solvent and the thermoplastic resin miscible with the vinylidene fluoride homopolymer or copolymer by use of a volatile liquid, followed by stretching with a stretching residual strain of 100% or less;

(B)   said solvent capable of forming a microporous membrane having the percolation structure being defined as such a solvent that, for solutions of the vinylidene fluoride homopolymer or copolymer with a weight average molecular weight of 1×10^5 or more having any concentrations in a range of 10 to 60 wt%, when dissolution temperature Ts is plotted as abscissa at regular intervals of 5°C, starting from Ts = 100°C, and the breaking extension TL of a membrane produced from the solution having each dissolution temperature is plotted as ordinate, a dissolution temperature at which $- (TL_{s+5} - TLs) / \{ (Ts + 5°C) - Ts\}$ (wherein TL_{s+5} is a TL value at Ts + 5°C and TLs is a TL value at Ts) becomes maximum is taken as Ts max, and a temperature 2.5°C higher than Ts max (Ts max + 2.5°C) is taken as Tu; ; on the other hand, when Ts is plotted as abscissa and the porosity P of the membrane as ordinate in the same manner as above, a dissolution temperature at which $(P_{s+5} - Ps) / \{(Ts + 5°C) - Ts\}$ (wherein P_{s+5} is a P value at Ts + 5°C and Ps is a P value at Ts) becomes maximum is taken as T's max, and a temperature 2.5°C higher than T's max (T's max + 2.5°C) is taken as Tl; and at least one solution having a concentration in the above range of the concentration of the vinylidene fluoride homopolymer or copolymer has both Tl and Tu in such a way that (Tu - Tl) > 0;

(C) $Tl \leqq Ts \leqq Tu$.

11. (Amended) A process for producing [a] **the** microporous membrane **according to claim 1** which comprises using a vinylidene fluoride homopolymer or copolymer having a weight average molecular weight of 1×10^5 or more and a solvent capable of permitting observation of planar liquid-liquid interface which is defined in (D) below, in a weight ratio of 10 : 90 to 60 : 40; uniformly dissolving the vinylidene fluoride homopolymer or copolymer in said solvent to obtain a one-phase solution at a dissolution temperature Ts 10°C or more higher than the cloud point temperature determined by a standing method; extruding the resulting solution with an extruder; cooling the extruded solution to form a gel-like shaped product composed of a two-phase gel; and then subjecting the shaped product to any treatment selected from the group consisting of the following treatments vii), viii) and ix):

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vii)   removing the solvent by use of a volatile liquid without stretching the shaped product;

viii)   stretching the shaped product with a stretching residual strain of 100% or less, and then removing the solvent by use of a volatile liquid; and

ix)   removing the solvent by use of a volatile liquid, followed by stretching with a stretching residual strain of 100% or less;

(D)   a solvent which makes it possible to observe the planar liquid-liquid interface between a phase rich in the vinylidene fluoride homopolymer or copolymer and a phase lean in the vinylidene fluoride homopolymer or copolymer by a standing method comprising lowering the temperature of a solution prepared by uniform one-phase dissolution of the vinylidene fluoride homopolymer or copolymer in the solvent to any concentration in a range of 10 to 60 wt%, to any observation temperature which is not lower than the crystallization temperature and is in a two-phase region, and allowing the solution to stand.

1. A microporous membrane produced by cooling a solution comprising a vinylidene fluoride homopolymer or copolymer having a weight average molecular weight of 1×10^5 or more and a solvent therefor, to form a two-phase gel, said microporous membrane comprising a polymer phase comprising said vinylidene fluoride homopolymer or copolymer, and intercommunicating voids which have an average pore size measured by the half-dry method of 0.005 to 5 μm and extend from one side of the membrane to the other side, and said microporous membrane having the percolation structure defined in (A) below, as its internal structure:

(A)   a structure in which the polymer phase forms an isotropic network structure by three- dimensional branching in arbitrary directions, the voids are formed within an area surrounded by said polymer phase of the network structure and intercommunicate with one another, and the ratio of the maximum pore size measured by the bubble point method to the average pore size measured by the half-dry method is 2.0 or less.

2. The microporous membrane according to claim 1, wherein the average pore size measured by scanning electron microscopy of the surface layer on at least one side of the microporous membrane is the same as or larger than the average pore size measured by scanning electron microscopy of the internal structure.

3. The microporous membrane according to claim 1, wherein the average pore size measured by scanning electron microscopy of the surface layer on at least one side of the microporous membrane is smaller than the average pore size measured by scanning electron microscopy of the internal structure.

4. The microporous membrane according to claim 1, wherein the average pore size measured by the half-dry method is 0.005 to 0.1 μm.

5. (Amended) A process for producing the microporous membrane according to claim 1 which comprises using a vinylidene fluoride homopolymer or copolymer having a weight average molecular weight of 1×10^5 or more and a solvent capable of forming a microporous membrane having a percolation structure as defined in (B) below, in a weight ratio of 10 : 90 to 60 : 40; dissolving said vinylidene fluoride homopolymer or copolymer in said solvent at a dissolution temperature Ts at which the percolation structure can be formed and which satisfies the condition described in (C) below; extruding the resulting solution with an extruder; cooling the extruded solution to form a gel- like shaped product composed of a two-phase gel; and then subjecting the shaped product to any treatment selected from the group consisting of the following treatments i), ii) and iii):

  i)   removing the solvent by use of a volatile liquid without stretching the shaped product,

  ii)   stretching the shaped product with a stretching residual strain of 100% or less and then removing the solvent by use of a volatile liquid,

  iii)   removing the solvent by use of a volatile liquid, followed by stretching with a stretching residual strain of 100% or less;

  (B)   said solvent capable of forming a microporous membrane having the percolation structure being defined as such a solvent that, for solutions of the vinylidene fluoride homopolymer or copolymer with a weight average molecular weight of 1×10^5 or more having concentrations in a range of 10 to 60 wt%, when dissolution temperature Ts is plotted as abscissa at regular intervals of 5°C, starting from Ts = 100°C, and the breaking extension TL of a membrane produced from the solution having each dissolution temperature is plotted as ordinate, a dissolution temperature at which
- $(TL_{S+5} - TLs) / \{ (Ts + 5°C) - Ts\}$ (wherein TL_{S+5} is a TL value at Ts + 5°C and TLs is a TL value at Ts) becomes maximum is taken as Ts max, and a temperature 2.5°C higher than Ts max (Ts max + 2.5°C) is taken as Tu; on the other hand, when Ts is plotted as abscissa and the porosity P of the membrane as ordinate in the same manner as above, a dissolution temperature at which $(P_{S+5} - Ps) / \{(Ts + 5°C) - Ts\}$ (wherein P_{S+5} is a P value at Ts + 5°C and Ps is a P value at Ts) becomes maximum is taken as T's max, and a temperature 2.5°C higher than T's max (T's max + 2.5°C) is taken as Tl; and at least one solution having a

concentration in the above range of the concentration of the vinylidene fluoride homopolymer or copolymer has both Tl and Tu in such a way that (Tu - Tl) > 0;

(C) $Tl \leq Ts \leq Tu$

6. The process for producing a microporous membrane according to claim 5, wherein a liquid cooling medium is at least one medium selected from solvents capable of forming a microporous membrane having the percolation structure.

7. The process for producing a microporous membrane according to claim 6, wherein the liquid cooling medium is at least one member selected from the group consisting of phthalic acid esters, benzoic acid esters, sebacic acid esters, adipic acid esters, trimellitic acid esters, phosphoric esters and ketones.

8. A gel-like shaped product composed of a two-phase gel which is obtained by using a vinylidene fluoride homopolymer or copolymer having a weight average molecular weight of 1×10^5 or more and a solvent capable of forming a microporous membrane having the percolation structure which is defined in (B) below, in a weight ratio of 10 : 90 to 60 : 40; dissolving said vinylidene fluoride homopolymer or copolymer in said solvent at a dissolution temperature Ts at which the percolation structure can be formed and which satisfies the condition described in (C) below; extruding the resulting solution with an extruder; and then cooling the extruded solution;

(B) said solvent capable of forming a microporous membrane having the percolation structure being defined as such a solvent that, for solutions of the vinylidene fluoride homopolymer or copolymer having any concentrations in a range of 10 to 60 wt%, when dissolution temperature Ts is plotted as abscissa at regular intervals of 5°C, starting from Ts = 100°C, and the breaking extension TL of a membrane produced from the solution having each dissolution temperature is plotted as ordinate, a dissolution temperature at which - $(TL_{s+5} - TLs) / \{ (Ts + 5°C) - Ts\}$ (wherein TL_{s+5} is a TL value at Ts + 5°C and TLs is a TL value at Ts) becomes maximum is taken as Ts max, and a temperature 2.5°C higher than Ts max (Ts max + 2.5°C) is taken as Tu; on the other hand, when Ts is plotted as abscissa and the porosity P of the membrane as ordinate in the same manner as above, a dissolution temperature at which $(P_{s+5} - Ps) / \{(Ts + 5°C) - Ts\}$ (wherein P_{s+5} is a P value at Ts + 5°C

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and Ps is a P value at Ts) becomes maximum is taken as T's max, and a temperature 2.5°C higher than T's max (T's max + 2.5°C) is taken as Tl; and at least one solution having a concentration in the above range of the concentration of the vinylidene fluoride homopolymer or copolymer has both Tl and Tu in such a way that (Tu - Tl) > 0;

       (C) $Tl \leqq Ts \leqq Tu$.

       9. (Amended) A process for producing the microporous membrane according to claim 1 which comprises using a vinylidene fluoride homopolymer or copolymer having a weight average molecular weight of 1×10^5 or more and a mixture of a solvent capable of forming a microporous membrane having a percolation structure which is defined in (B) below and a thermoplastic resin miscible with said vinylidene fluoride homopolymer or copolymer, in a weight ratio of 10 : 90 to 60 : 40; dissolving the vinylidene fluoride homopolymer or copolymer and the thermoplastic resin miscible therewith in the said solvent at a dissolution temperature Ts at which the percolation structure can be formed and which satisfies the condition described in (C) below, under such conditions that the total amount of said vinylidene fluoride homopolymer or copolymer and the thermoplastic resin miscible therewith is 60 wt% or less based on the weight of the resulting solution consisting of said vinylidene fluoride homopolymer or copolymer, said thermoplastic resin and said solvent, and the weight ratio of said vinylidene fluoride homopolymer or copolymer to the thermoplastic resin miscible therewith is 40 : 60 to 90 : 10; then extruding the solution with an extruder; cooling the extruded solution to form a gel-like shaped product composed of a two-phase gel; and then subjecting the shaped product to any treatment selected from the group consisting of the following treatments iv), v) and vi):

       iv)   removing the solvent and the thermoplastic resin miscible with the vinylidene fluoride homopolymer or copolymer by use of a volatile liquid without stretching the shaped product;

       v)   stretching the shaped product with a stretching residual strain of 100% or less, and then removing the solvent and the thermoplastic resin miscible with the vinylidene fluoride homopolymer or copolymer by use of a volatile liquid; and

       vi)   removing the solvent and the thermoplastic resin miscible with the vinylidene fluoride homopolymer or copolymer by use of a volatile liquid, followed by stretching with a stretching residual strain of 100% or less;

(B)   said solvent capable of forming a microporous membrane having the percolation structure being defined as such a solvent that, for solutions of the vinylidene fluoride homopolymer or copolymer with a weight average molecular weight of 1×10^5 or more having any concentrations in a range of 10 to 60 wt%, when dissolution temperature Ts is plotted as abscissa at regular intervals of 5°C, starting from Ts = 100°C, and the breaking extension TL of a membrane produced from the solution having each dissolution temperature is plotted as ordinate, a dissolution temperature at which $-(TL_{S+5} - TLs)/\{(Ts + 5°C) - Ts\}$ (wherein TL_{S+5} is a TL value at Ts + 5°C and TLs is a TL value at Ts) becomes maximum is taken as Ts max, and a temperature 2.5°C higher than Ts max (Ts max + 2.5°C) is taken as Tu; ; on the other hand, when Ts is plotted as abscissa and the porosity P of the membrane as ordinate in the same manner as above, a dissolution temperature at which $(P_{S+5} - Ps)/\{(Ts + 5°C) - Ts\}$ (wherein P_{S+5} is a P value at Ts + 5°C and Ps is a P value at Ts) becomes maximum is taken as T's max, and a temperature 2.5°C higher than T's max (T's max + 2.5°C) is taken as Tl; and at least one solution having a concentration in the above range of the concentration of the vinylidene fluoride homopolymer or copolymer has both Tl and Tu in such a way that (Tu - Tl) > 0;

(C) $Tl \leq Ts \leq Tu$.

10. The process for producing a microporous membrane according to claim 5 or 9, wherein the solvent capable of forming a microporous membrane having the percolation structure which is defined in (B) is at least one member selected from the group consisting of phthalic acid esters, benzoic acid esters, sebacic acid esters, adipic acid esters, trimellitic acid esters, phosphoric esters and ketones.

11. (Amended) A process for producing the microporous membrane according to claim 1 which comprises using a vinylidene fluoride homopolymer or copolymer having a weight average molecular weight of 1×10^5 or more and a solvent capable of permitting observation of planar liquid-liquid interface which is defined in (D) below, in a weight ratio of 10 : 90 to 60 : 40; uniformly dissolving the vinylidene fluoride homopolymer or copolymer in said solvent to obtain a one-phase solution at a dissolution temperature Ts 10°C or more higher than the cloud point temperature determined by a standing method; extruding the resulting

solution with an extruder; cooling the extruded solution to form a gel-like shaped product composed of a two-phase gel; and then subjecting the shaped product to any treatment selected from the group consisting of the following treatments vii), viii) and ix):

vii)   removing the solvent by use of a volatile liquid without stretching the shaped product;

viii)   stretching the shaped product with a stretching residual strain of 100% or less, and then removing the solvent by use of a volatile liquid; and

ix)   removing the solvent by use of a volatile liquid, followed by stretching with a stretching residual strain of 100% or less;

(D)   a solvent which makes it possible to observe the planar liquid-liquid interface between a phase rich in the vinylidene fluoride homopolymer or copolymer and a phase lean in the vinylidene fluoride homopolymer or copolymer by a standing method comprising lowering the temperature of a solution prepared by uniform one-phase dissolution of the vinylidene fluoride homopolymer or copolymer in the solvent to any concentration in a range of 10 to 60 wt%, to any observation temperature which is not lower than the crystallization temperature and is in a two-phase region, and allowing the solution to stand.

12. A process for producing a microporous membrane according to any one of claims 5, 9 and 11, wherein the solution extruded with the extruder is cooled with at least one member selected from the group consisting of liquid cooling media, air and rolls.